HF Data Link
Background and Future Plans

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HFDL Presentation Overview

- Service Overview
- Traffic and Performance
- System Enhancements
- Service Enhancements
- Future Plans

HF Data Link (HFDL) Service Overview

- **HFDL is an Certified Airline Industry Data Link**
  - *Along with VHF and SATCOM, HFDL provides ATC and AOC data link communications to the airline industry*
  - *HFDL uses the same Air-Ground and Ground-Ground messaging protocols*
  - *Difference is in the Link Layer which uses the HF spectrum (3 – 30 MHz).*
  - *Air-Ground Message Transmission Speed varies depending on radio wave propagation conditions.*
    - 300, 600, 1200, or 1800 bps
  - *ARINC is the sole provider of HFDL service (GLOBALink/HF Data Link)*

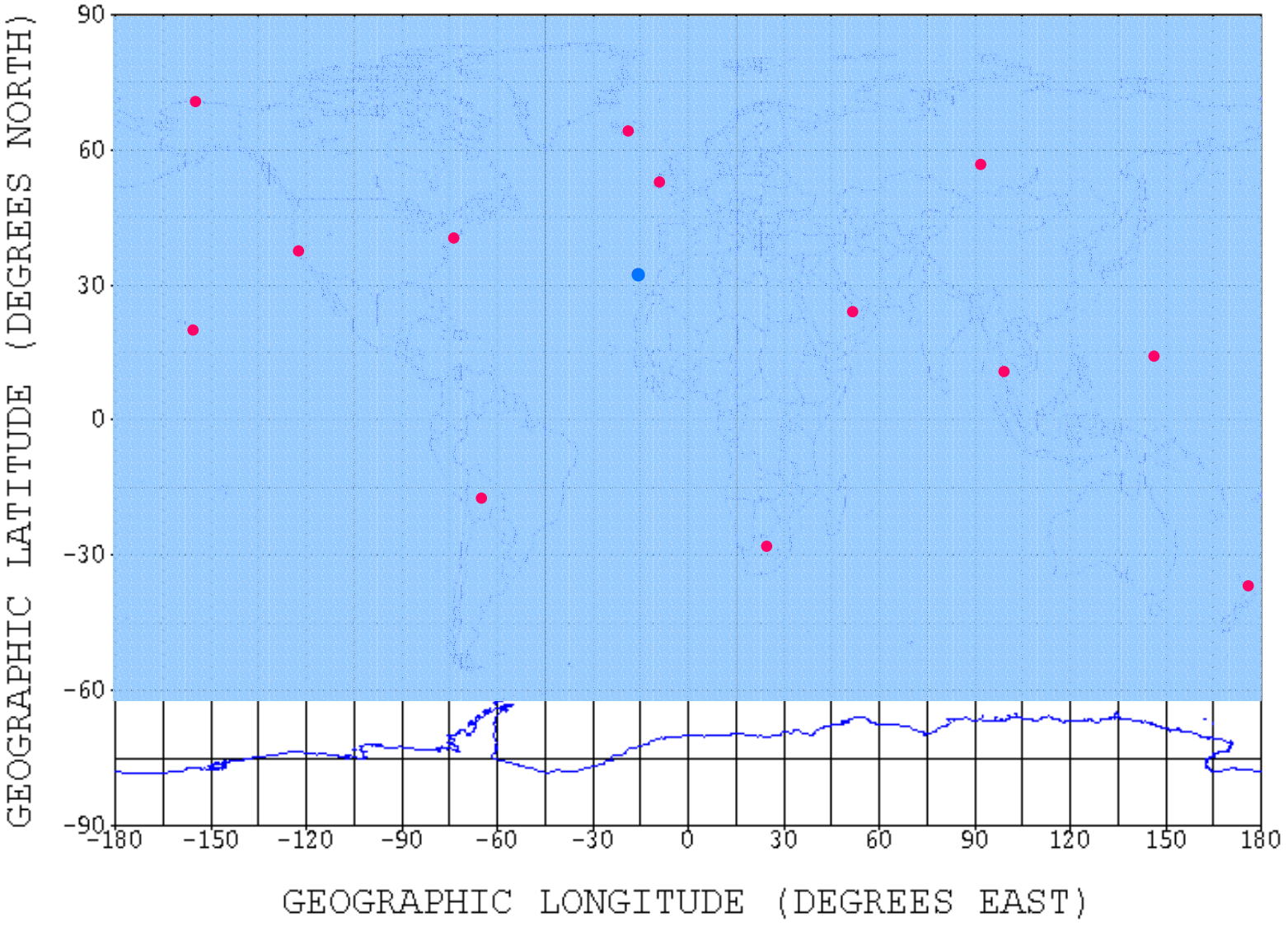
- **Industry Approvals**
  - *ICAO SARPs and HFDL Manual*
  - *RTCA MASPS*
  - *RTCA MOPS*
  - *AEEC Specification 635*

HFDL Service Overview

- **14 ground stations**
  - *Dixon, CA, U.S.A*
  - *Molokai, HI, U.S.A.*
  - *Reykjavik, Iceland*
  - *Riverhead, NY, U.S.A.*
  - *Auckland, New Zealand*
  - *Hat Yai, Thailand*
  - *Shannon, Ireland*
  - *Johannesburg, South Africa*
  - *Barrow, AK, U.S.A.*
  - *Santa Cruz, Bolivia*
  - *Krasnoyarsk, Russia*
  - *Al Muharraq, Bahrain*
  - *Pulantant, Guam*
  - *Las Palmas, Canary Islands*

- **Traffic currently exceeding 400,000 messages per month**
  - *2002 year-end traffic exceeds 318,000,000 messages*
  - *2002 was +53% over 2001*
  - *2003 running +62% over 2002*

HFDL Global Coverage



HF Ground Stations

Alaska
Bahrain
Bolivia
California
Canary Islands
Guam
Hawaii
Iceland
Ireland
New York
New Zealand
Russia
South Africa
Thailand

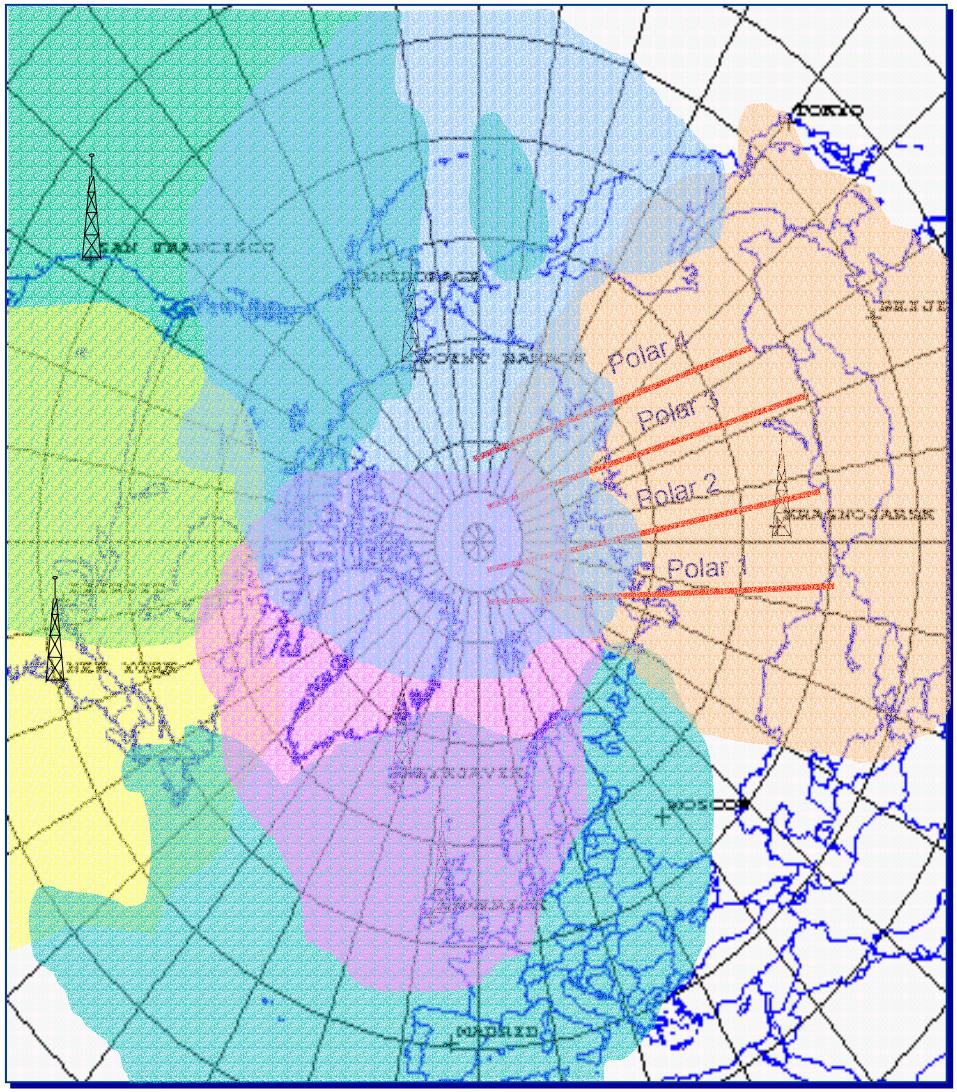
Legend

- HFDL ground station

Areas of Primary coverage

Areas of Secondary coverage

HFDL North Polar Coverage



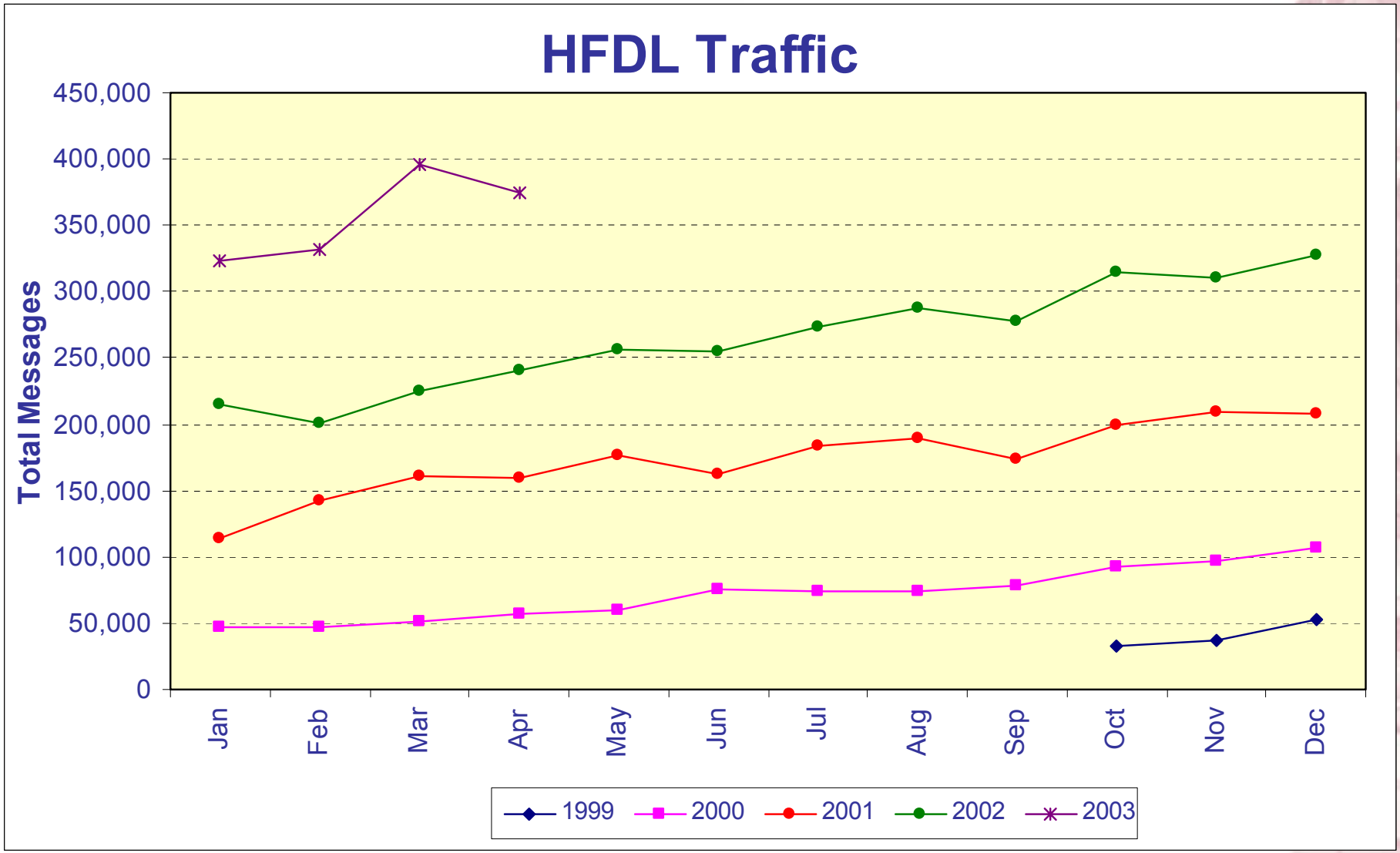
HFDL Stations

- San Francisco, California
- Riverhead, New York
- Shannon, Ireland
- Reykjavik, Iceland
- Krasnoyarsk, Russia
- Barrow, Alaska

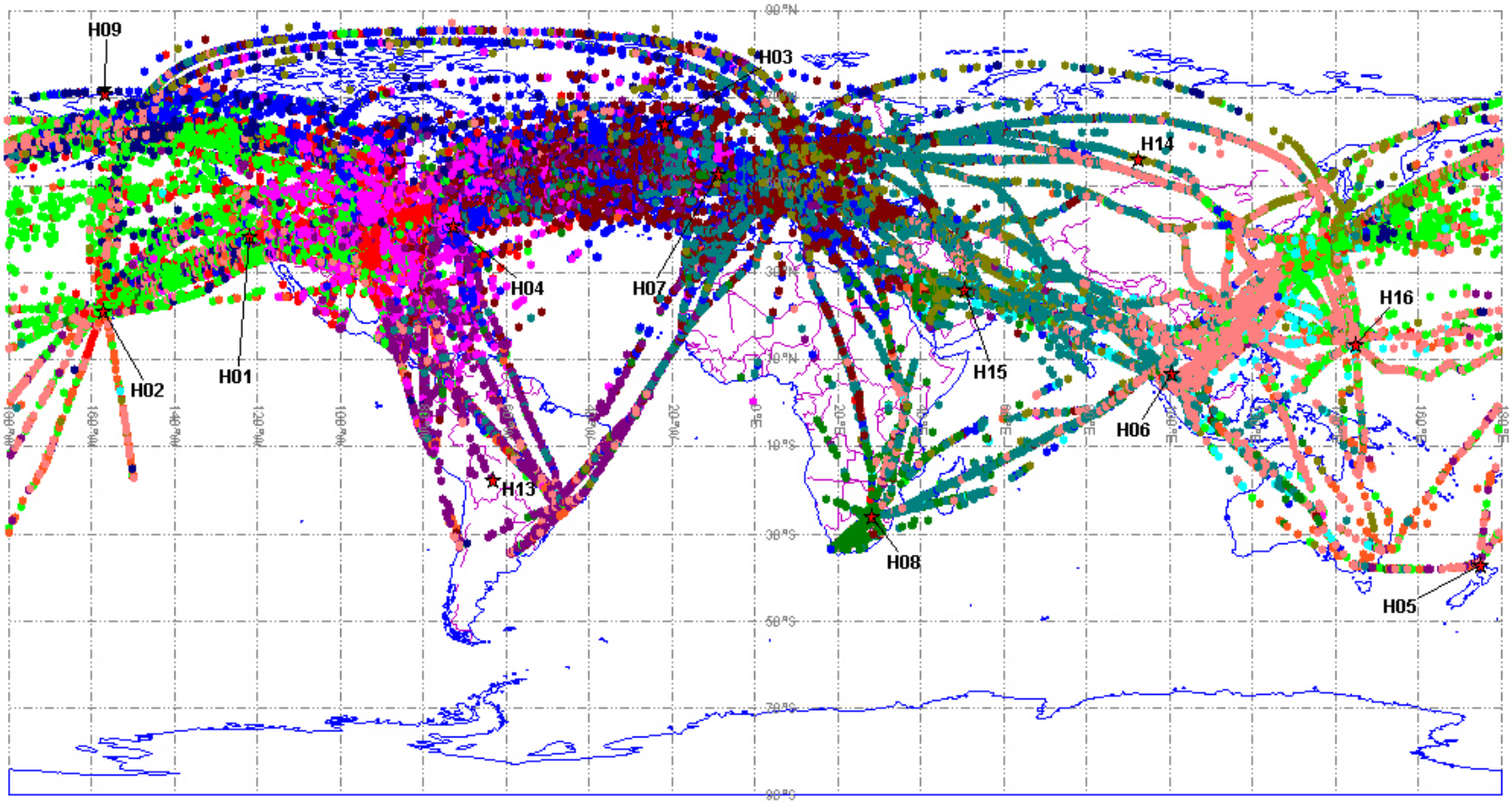
Polar Routes (1 - 4)

HFDL is the world's only North Polar data link communications capability

HFDL Systemwide Usage



GLOBALink/HF Contacts – March 2003



- H01 - California, USA
- H02 - Hawaii, USA
- H03 - Iceland
- H04 - New York, USA
- H05 - New Zealand
- H06 - Thailand
- H07 - Ireland
- H08 - South Africa
- H09 - Alaska, USA
- H13 - Bolivia
- H14 - Russia
- H15 - Bahrain
- H16 - Guam

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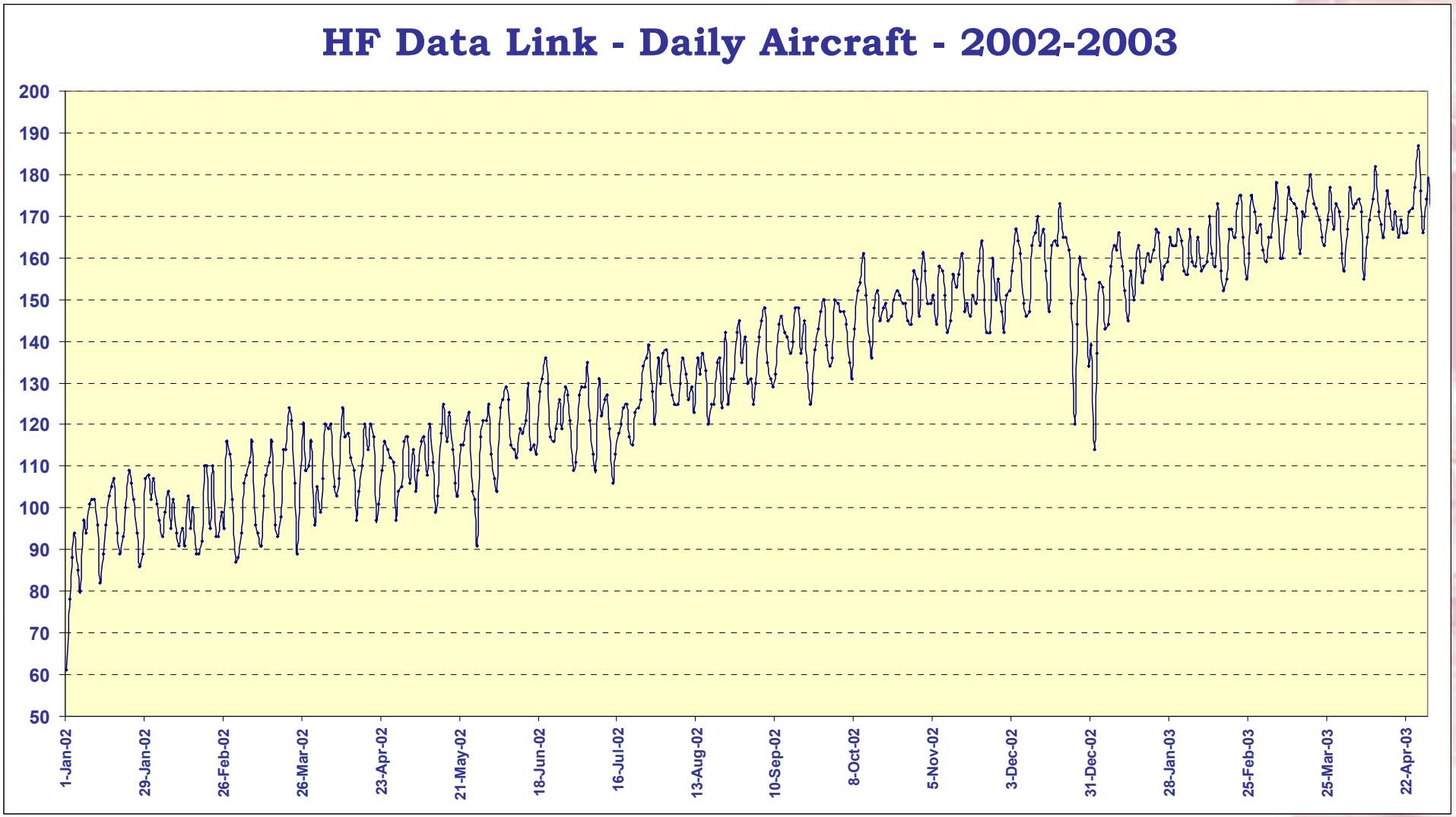
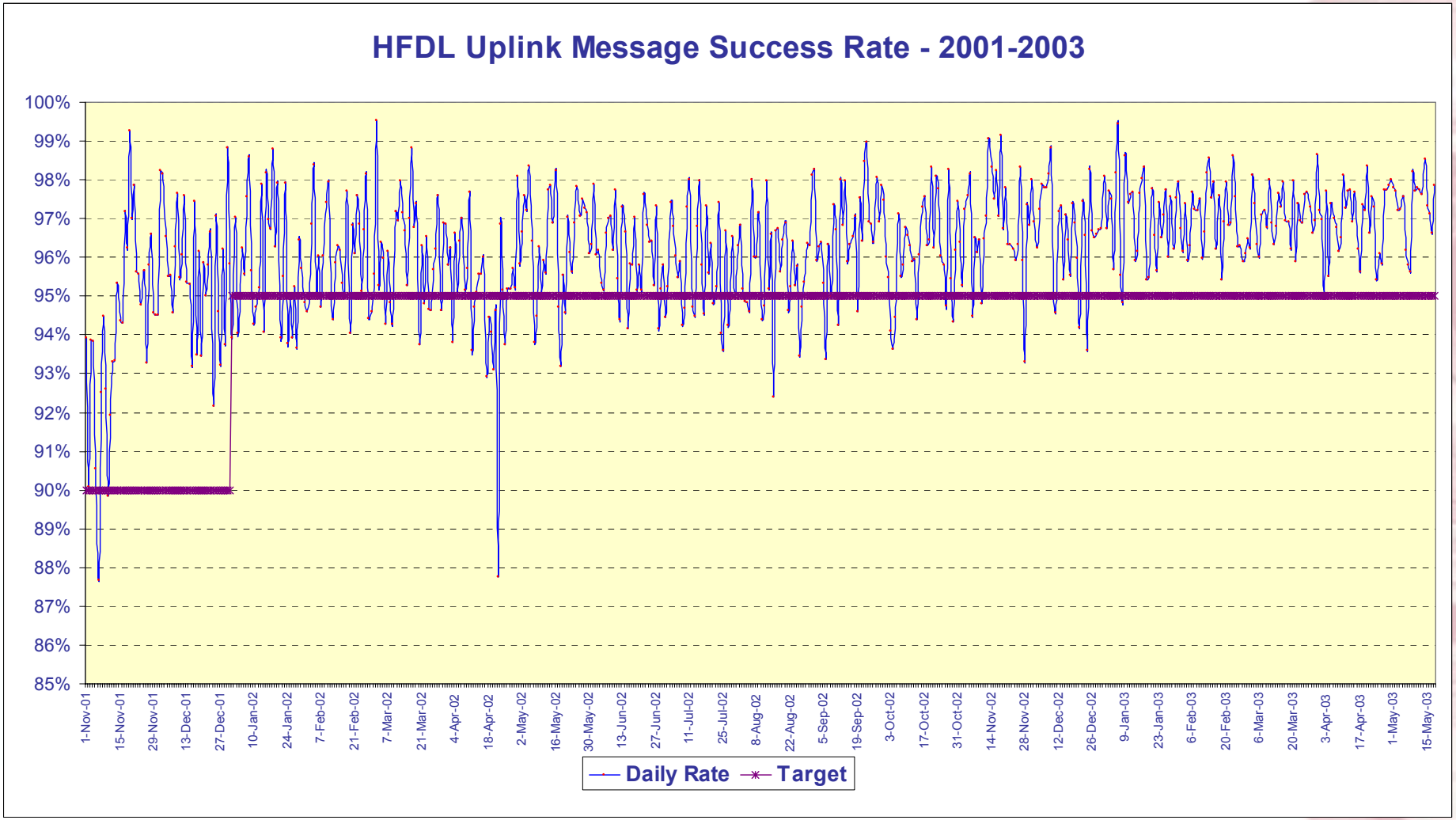
March 2003

HFDL Daily Aircraft



HFDL Daily Performance



System Enhancements

- **Al Muharraq, Bahrain**
  - ***New site installation*** *– cutover 11 January 2002*
- **Hat Yai, Thailand**
  - *Additional frequencies added – Jan 2002*
  - *Upgraded data network*
- **Santa Cruz, Bolivia**
  - *Additional frequencies added – Jan 2002*
- **Agana, Guam**
  - *Receive antenna re-located – Apr 2002*
- **Molokai, Hawaii**
  - *3rd Transmitter antenna activation - May 2002*
  - *Directional antenna will provide coverage for North/Northwest Pacific*
- **Krasnoyarsk, Russia**
  - *New antennae installed – March 2002*
  - *Additional frequencies will be added pending licensing*

Service Enhancements

- **Adaptive Frequency Management**
  - *Active Frequency Table (AFT) derived from combination of real-time ionospheric monitoring, solar and geomagnetic observational data and HF propagation programs*
  - *AFTs optimize the daily/hourly operating frequencies at all HFDL Ground Stations*
  - *Aircraft intercepts are actively monitored to locate under-performing avionics*

- **Uplink Message Retry Timer Reconfiguration**
  - *From: 1st block attempt with 2 retries every 180 seconds*
  - *To: 1st block attempt with 6 retries every 70 seconds*
  - *Average message success rate improved to **> 97%***

- **HF Data Radio (HFDR)**
  - *Alternate ground station selection based on trending analysis by airborne radio*
  - *Causes an elegant transfer on communications between declining frequency and improving frequency*

HFDL Future Plans

- **HFDL Ground Station in Canary Islands**
  - *Scheduled for 3Q2003*
  - *Provides Primary Coverage to South Atlantic and Western Africa*
  - *Provides Secondary coverage to the North Atlantic and South America*

- **Industry Approvals**
  - *ICAO SARPs and HFDL Manual*
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HFDL Future Plans

- **ATC Validation Activities**
  - *North Atlantic*
    - FMC position report via HFDL underway with Continental Airlines and Finnair
      - Approved for use with FMC-WPRs
      - Pending CPDLC/ADS approval
  - *USAF KC-135 Trials*
    - Trials conducted 01-10 May 2003
    - Data being analyzed
  - *Japan (Ministry of Post and Telecommunications)*
    - Trials with Japan Airlines and All Nippon Airways completed
    - Data Being Analyzed

Summary

- Site and system upgrades continue to improve HFDL performance and enhance end-to-end reliability
- Continued growth
- Improved coverage through the addition of ground stations and HF frequencies
- ATC validation efforts ongoing